CALIFORNIA DIVISION OF MINES AND GEOLOGY

Fault Evaluation Report FER-18

January 10, 1977

1. Name of faults: Culbertson, Orcutt, Steckel, and Thorpe faults and related faults.

2. Location of faults: Santa Paula ~~Creek~~ Peak and Fillmore quadrangles, Ventura County, California.

3. Reason for evaluation: Part of 10-year program; in part, zoned in the Ventura County Seismic and Safety Element (Nichols, 1974).

4. List of references:

a) Bertholf, H.W., 1967, Geology and Oil Resources of the Timber Canyon area, Ventura County, California: Unpublished M.S. thesis, University of California, Los Angeles, 56 p., 10 pl., geologic map scale 1:12,000.

b) Dibblee, T.W., Jr., 1939, Unpublished geologic map~~ping~~ of the Santa Paula quadrangle, scale 1:62,500.

c) McCullough, T.M., 1957, The geology of the Timber Canyon area, Santa Paula Peak quadrangle, Ventura County, California: Unpublished M.A. thesis, University of California, Los Angeles, 67 p., geologic map scale 1:18,000.

d) Nichols, D.R., October 1974, Surface Faulting in General Discussion in Seismic and Safety Elements of the Resources Plan and Program, Ventura County Planning Department, section II, p. 1-35, pl. 1.

e) Weber, H.F., Jr., Clevelead, G.B., Kahle, J.E., Kiessling, E.F., Miller, R.V., Mills, M.F., Morton, D.M., and Cilweck, B.A., 1973, Geology and mineral resources study of southern Ventura County, California: California Division of Mines and Geology, Preliminary Report 14, 102 p., map scale 1:48,000.

f) Weber, F.H., Jr., Kiessling, E.W., Sprotte, E.C., Johnson, J.A., Sherburne, R.W., and Cleveland, G.B., 1975, Seismic hazards study of Ventura County, California: California Division of Mines and Geology, Open File Report 76-5LA, 396 p., 9 plates.

g) Ziony, J.I., Wentworth, C.M., Buchanan-Banks, J.M., and Wagner, H.C., 1974, Preliminary map showing recency of faulting in coastal southern California: U.S. Geological Survey, Miscellaneous Field Studies Map MF-585, 15 p., map scale 1:250,000, 3 plates.

5. Summary of available data: Except for the Steckel and Thorpe faults, and some faults shown only in Weber, et al (1975), all the faults discussed in this FER are zoned in the Ventura County Seismic and Safety Element as secondary fault hazards (Nichols, 1974, after Weber, et al., 1973).

All or most of the faults addressed are supposedly east-west trending, north-dipping, normal faults (McCullough, 1957, p. 55; Bertholf, 1967, p. 30-31). McCullough felt that these faults were Holocene in age. Both McCullough and Bertholf based these faults on scarps present in terrace deposits. McCullough felt that the scarps were largely the result of movement along bedding planes in the underlying bedrock. Weber, et al. (1975) analyzed the features along these faults and noted that these features result from "apparent youthful" fault activity. Ziony, et al. (1974) depict all of the named faults as having been active during late Quaternary time.

Plate 1 presents McCullough's (1956) verison. Note that he distinguishes Holocene fan deposits from terrace (presumed to be late Pleistocene) deposits. Plate 2 is Bertholf's (1967) version. He not only distinguishes between Holocene fans and Pleistocene terrace deposits, but subdivides the terraces into two units. Plate 3 presents the faults shown by Weber, et al. (1973, shown in orange), which was compiled after Bertholf and McCullough; also shown (in green) is Weber, et al. (1975). The Weber, et al. (1975) map depicts all of the faults shown in Weber, et al. (1973), making some changes (as noted on plate 3). Both of the Weber, et al. references depict several ages of fan deposits. For the sake of clarity I will refer to all Pleistocene fan and terrace units as terraces, and all Holocene(?) units as fans.

THORPE FAULT

McCullough (1957) shows the Thorpe fault as cutting Quaternary terrace deposits near Orcutt Canyon. Bertholf (1967) shows the fault as buried under both of these deposits. Weber, et al. (1973) agrees with Bertholf's version, however, the more recent Weber, et al. (1975) report depicts the fault (approximately located) as cutting the Timber Canyon fan deposits, noting that evidence of Holocene(?) fault movement exists.

CULBERTSON FAULT

McCullough (1957) mapped only a very short part of the Culbertson fault, and Bertholf (1967) mapped a somewhat longer segment; neither, however, depicted the fault as cutting the Timber Canyon fan. Both authors do show an offset of an adjacent older terrace. Weber, et al. (1975) indicate that the fault does cut the Timber Canyon fan and thus, may have been active in Holocene time.

STECKEL FAULT

The Steckel fault was mapped by Bertholf (1967) as a normal, north dipping fault (at the surface - Bertholf feels these may be south dipping at depth). Bertholf mapped the fault as not cutting younger Pleistocene terrace deposits and as bounding (cutting?) older terrace deposits of Santa Paula Creek.

Weber, et al. (1973) show the fault as cutting upper Pleistocene terrace deposits and older alluvial deposits (also Pleistocene). Weber, et al. (1975) depict the same fault as not cutting the terrace deposits, but as cutting the older alluvial deposits (which are older than the terrace deposits).

ORCUTT FAULT

The Orcutt fault is mapped by both Bertholf (1967) and McCullough (1957) as cutting terrace deposits. McCullough also shows a parallel trace, about 300 feet away, as cutting terrace deposits. Weber, et al. (1975) depict a third trace in addition to the other two; all of these cut the same terrace deposits, but the added trace does not cut a younger, upper Pleistocene terrace.

OTHER FAULTS

McCullough (1957) maps two other faults (one in sec. 35, one in sec. 36, T 4 N., R. 21 W., SBB&M, both shown in orange on plate 3) as cutting terrace deposits. Ziony, et al. (1974), Weber, et al. (1973), and Weber, et al. (1975) each replotted these faults and classified both as late Quaternary in age. Weber, et al. (1975) show two additional faults which cut late Quaternary deposits (one of which cuts Holocene(?) deposits along Santa Paula Creek) and two faults which are confined to pre-Quaternary bedrock (see plate 3, sec. 36, T. 4 N., R. 21 W.).

Several air photo lineaments south of the Steckel fault, which may be faults, were also noted by Weber, et al. (1975).

6. Interpretation of air photos: U.S. Department of Agriculture aerial photographs AXI-1K numbers 66 through 68, 47 through 50, and AXI-3K numbers 137 and 138 were viewed stereoscopically ~~optically~~. Several well-defined scarps were observed, along with tonal features, etc. This data has been plotted and annotated on plate 3, ~~1~~.

7. Field observations: On November 16 and 17, 1976, I visited the Orcutt Canyon and Timber Canyon areas. I found that the bedrock in Orcutt Canyon strikes N 70° W and dips nearly vertically. Differential erosion has created some linear depressions such as those noted in the north half of section 36 (plate 1). With one possible exception, all of the topographic features in sections 24, 25, and 36, T. 4 N., R. 21. W. noted on the air photos were observed in the field are still present. That one exception is the scarp in the Timber Canyon fan, just north of the mapped trace of the Culbertson fault. While there is an apparent escarpment here, it may be the result of road-grading. The trace of the Thorpe fault across Timber Canyon was not visited.

In Orcutt Canyon, I made several observations which apply to each of the Thorpe, Culbertson and Orcutt faults:

1. General escarpments or breaks in slope are present in the fan deposits along these faults.

2. The bedding in the bedrock near these faults is either nearly vertical or is steeply dipping. Thus, in the bedrock these faults are most likely bedding plane faults.

3. The Orcutt fan deposit is quite thick. It has been incised by streams to depths of more than 100 feet in places without exposing bedrock. Thus, the Orcutt fan is quite old, certainly pre-Holocene.

4. Where the escarpments across the fan are sometimes quite high (e.g., 15± feet), they are usually armored by large boulders. I suggest that the finer materials have been washed away, leaving the larger material. Such armoring serves to preserve the escarpments for a much longer time.

5. Most of these escarpments cannot be traced laterally across the bedrock outcrops. Where scarps are present in the bedrock, they are often very subtle much smaller than the armored scarps, and cannot be traced very far. Most of the topographic features in the bedrock are probably the result of differential erosion of beds of varying resistance.

6. I was nowhere able to observe a fault in the bedrock; however, the exposures were limited and the recognition of a bedding plane fault is most often difficult.

7. I was not able to observe an offset in the fanglomerate. However, north-dipping beds were observed directly beneath the Thorpe escarpment on the east side of Orcutt Canyon. Where bedding was noted in the fanglomerate elsewhere, the beds were south-dipping parallel to the surface of the old fan. The north-dipping beds could be drag folds along an adjacent fault. Slide debris obscured the area where such a fault would be exposed.

Based on these data, I feel reasonably certain that these features are the surface expression of faulting.

The escarpment along the Thorpe fault also has one additional feature. Remnants of a younger alluvial deposit remain just north of the scarp. This indicates that after the scarp formed, it acted as a dam behind which the younger alluvium was deposited. The scarp has since been breached by the intermittent stream, and the alluvium has been incised about 2 feet in depth. In mid-December 1976, I again visited the Thorpe fault where it crosses Orcutt Canyon. This time several other geologists from the Los Angeles, San Francisco, and Headquarters offices accompanied me (this was a field trip stop). Several possible origins for the escarpment were suggested: erosion, landsliding of the northern block of fan deposits, and the like. However, these theories do not sufficiently account for the change in dip of the bedding (the site where the change in attitude was observed was not visited on this trip). Hart noted that if this scarp were a fault scarp, then the amount of vertical displacement could have been 30 to 50 feet; however, he was not convinced that this feature was the result fault movement.

8. <u>Conclusions:</u> As already noted (item 7) I am reasonably certain that these features are faults. The fact that they are expressed in fanglomerates of late Pleistocene(?) age indicates that they are at least as young as the late Pleistocene(?). Armoring of these features would preserve them for a very long time, probably more than 12,000 years; thus, the scarps cannot be used as an indication of Holocene activity, unless the deposits are actually Holocene in age. However, I believe that most of the deposits which Weber, et al. (1975) consider to be Holocene(?) are actually late Pleistocene, since most are either highly dissected or are now elevated a considerable height above the

present flood plains. I think that perhaps only the Timber Canyon fan might be Holocene[(?)] in age. Further, if these features were very recent, one would expect them to be preserved in the surrounding bedrock as well. Thus, it is my opinion that these faults are late Pleistocene(?) in age and that there is insufficient evidence to assign any younger age to them. In all probability, these faults have not been active during the Holocene. The subject faults could have been created by movements in the upper block of a thrust fault. Such a thrust fault has been postulated, by Weber, et al (1975), as bordering the northern margin of the Santa Clara valley. Such a mechanism could readily account for the discontinuous pattern of short-length, broadly distributed faults.

Those faults which do not cut some late Pleistocene units (see item 5) are considered to be pre-Holocene in age.

All of these faults are reasonably well-defined where they cross late Pleistocene(?) fans. However, these same faults are difficult to locate in bedrock areas. This is because most are probably bedding-plane faults. As a group, these faults constitute a broad, ill-defined zone.

Thus, none of these faults appear to meet the current criteria for sufficiently-active faults; and only in selected localities can they be considered well-defined.

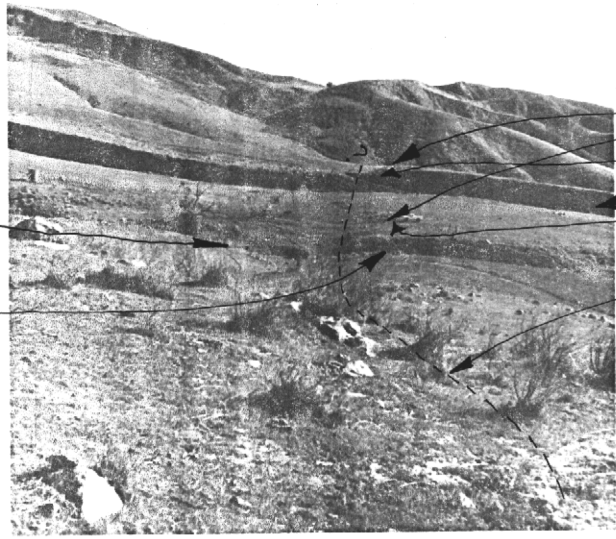

PHOTO 1. Thorpe fault at Orcutt Canyon, looking east.

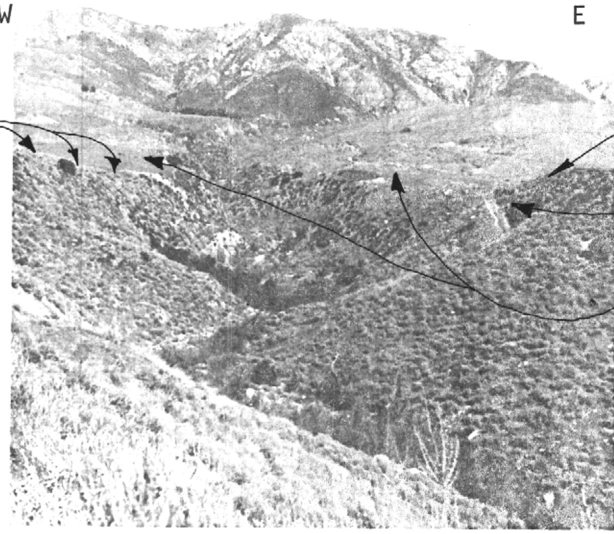

PHOTO 2. Thorpe fault at Orcutt Canyon, looking north.

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PHOTO 3. "Lineament" east of Timber Canyon immediately north of mapped trace of Culbertson fault.

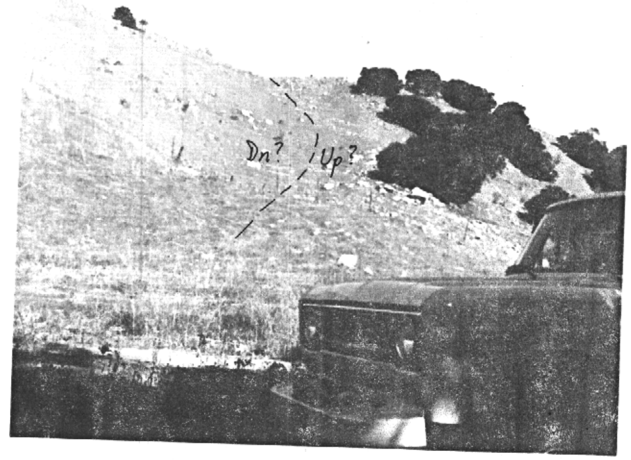

PHOTO 4. Second photo, same as Photo 3, forming a stereo pair.

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9. Recommendations: Based on the information summarized in this report, the Thorpe, Culbertson, Steckel, and related faults should not be zoned at this time.

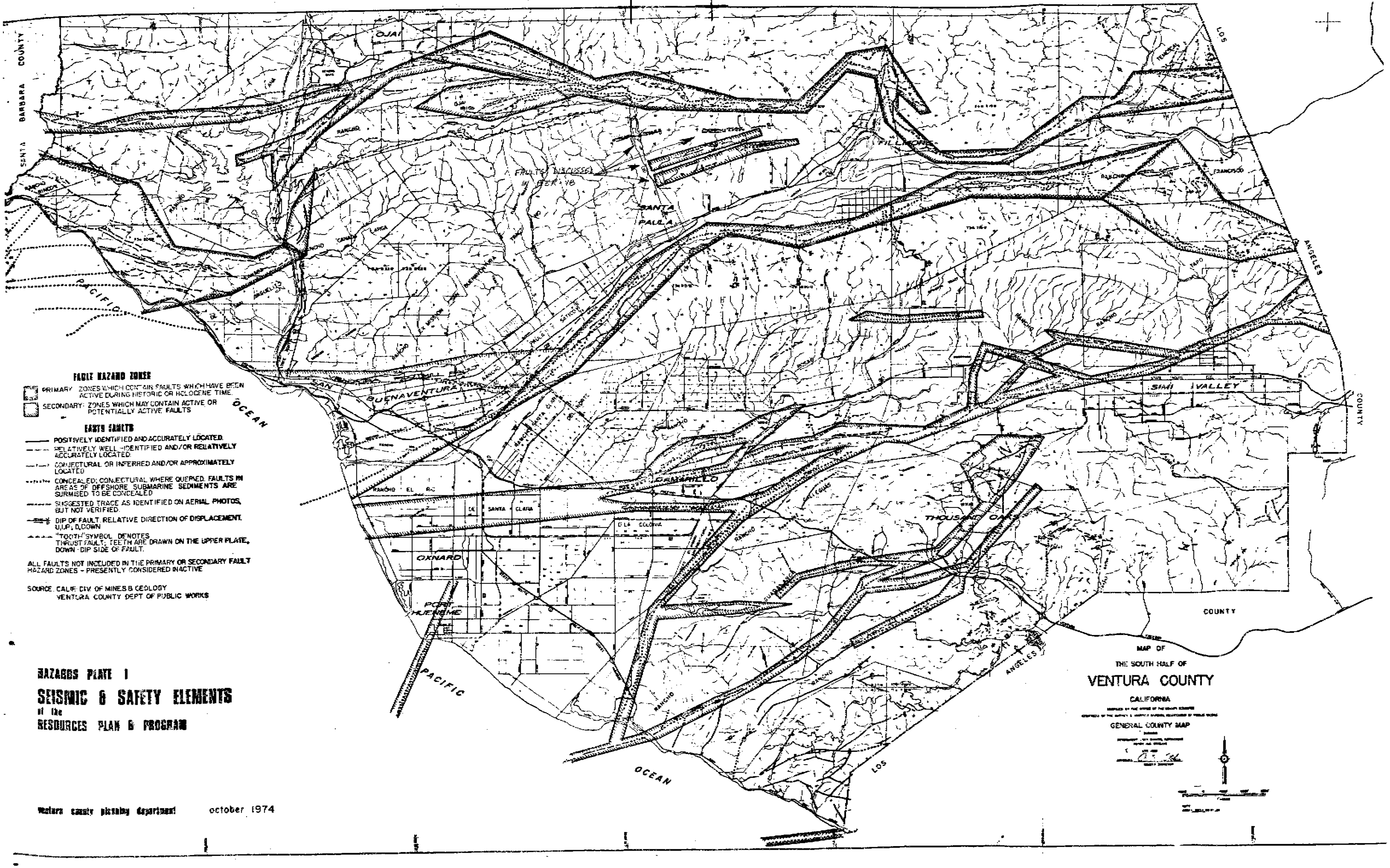
10. Investigating geologist's name; date:

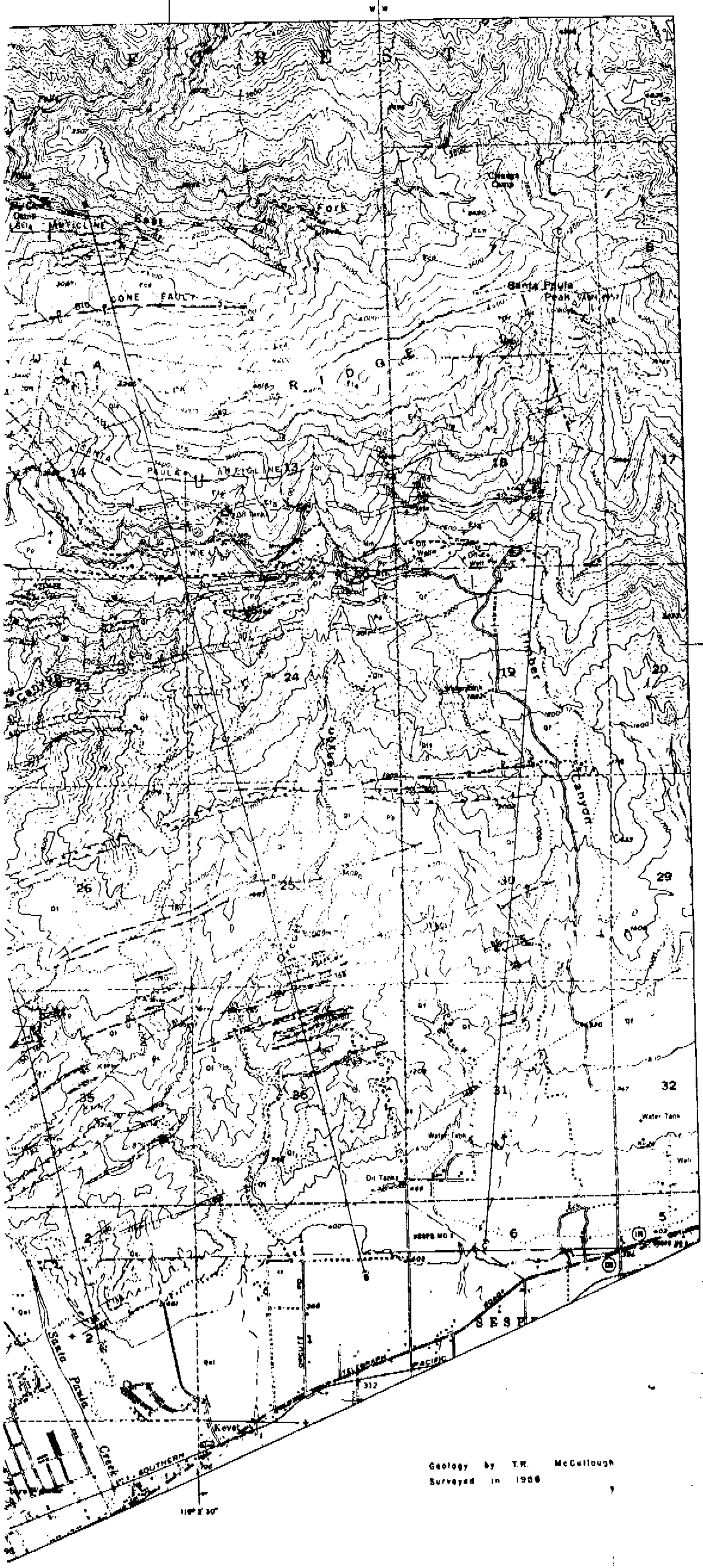
Theodore C. Smith

Theodore C. Smith
Assistant Geologist
January 10, 1977

I agree with recommendations.
EWH
1/21/77

Figure 1. Faults discussed in FER-18. (From Nichols, 1974, plate 1).





EXPLANATION

QUATERNARY

PLEISTOCENE–RECENT

Qf Qls Qsl

Boulders, sand, silt, and clay occurring as fanglomerate (Qf), landslide and slump material (Qls), and stream deposits (Qsl)

RECENT SURFICIAL DEPOSITS

Qt

Boulders, sand and silt

TERRACE DEPOSITS

Qs

Conglomerate lenses, sandstone, sandy-siltstone, siltstone and mudstone

SAUGUS FORMATION

PLIOCENE

Pp

Dominantly mudstone and siltstone interbedded with subordinate amounts of sandstone and conglomerate

PICO FORMATION

TERTIARY

MIOCENE

Msm

Chocolate-colored shale

"SANTA MARGARITA" FORMATION

Mm

Finely laminated, diatomaceous and siliceous shale

MONTEREY FORMATION

EOCENE

Ecw

Dominantly sandstone and pebbly-sandstone with subordinate amounts of shale

"COLDWATER" FORMATION

Ecd

Dominantly shale interbedded with subordinate amounts of sandstone

COZY DELL FORMATION

Em

Dominantly sandstone interbedded with subordinate amounts of shale

MATILIJA FORMATION

TOPATOPA FORMATION (Equivalent to upper Matilija in age)

Et_4

Massive, white-spotted, sandstone

SPOTTED SANDSTONE MEMBER

Et_3

Coarse-grained sandstone

UPPER WHITE SANDSTONE MEMBER

Et_2

Massive, fine-grained sandstone

GRAY SANDSTONE MEMBER

Et_1

Medium-grained sandstone

LOWER WHITE SANDSTONE MEMBER

SYMBOLS

BEDDING:

30 Strike and dip of strata

170 Strike and dip of overturned strata

CONTACTS:

Contact, accurately located, dashed where approximately located

Contact, surficial deposits (fan, landslide, slump, terrace, and alluvial material)

MAPPABLE BEDS:

Sandstone bed, showing boundaries

Conglomerate bed, showing boundaries

FOLDS

Anticline, showing trace of axial plane and direction of plunge, dashed where approximately located

Overturned anticline, showing trace of axial plane, dashed where approximately located

Syncline, showing trace of axial plane, dashed where approximately located

FAULTS

Thrust fault, showing hanging wall side, dashed where approximately located

Fault, showing relative vertical movement, dashed where approximately located, inferred

Fault, showing relative lateral movement, dashed where approximately located

MISCELLANEOUS SYMBOLS:

Marine invertebrate fossil locality

Landslide and slump, showing direction of movement

Oil seep

Oil well, producing

Oil well, uncompleted abandoned

Oil well, uncompleted idle

Oil well, completed abandoned

Water well

GEOLOGIC MAP OF THE TIMBER CANYON AREA, SANTA PAULA PEAK QUADRANGLE, VENTURA COUNTY, CALIFORNIA

Scale 1:18000

0 1 Mile

1000 0 4000 Feet

Contour interval 20 & 40 feet
Datum is mean sea level
1956

-Reduce this line to this SIZE

FGR-18

Plate 1

From McCullough, 1956